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ABSTRACT OF A LECTURE
UPON THE
CLASSIFICATION AND STRUCTURE OF THE LEECH,

DELIVERED BEFORE THE MEMBERS OF THE PHARMACEUTICAL SOCIETY.

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THE lecturer commenced by adverting to the position which the leech occupies in the animal kingdom, showing that it belonged to the *Annelida*, the first class of the sub-kingdom *Articulata* or *Homogangliata*. This class, which includes the worms properly so called, has been divided into four orders, one of which, the *Annelida suctoria*, is principally composed of the family *Hirudinea* or leeches: they are known by their having a soft, naked, segmented body, terminated at each extremity by a prehensile sucking disc. The anterior one has the mouth in its centre, and *may or may not be armed with teeth*. The intestinal canal is sacculated. They have red blood, which is kept circulating, or rather undulating, by the pulsation of four longitudinal vessels. Their respiration is cuticular. The nervous system consists of a brain and ventral chain of ganglia. They have from two to ten eyes, situated upon the dorsal surface of the anterior segments. They are reproduced by ova, and the sexes are combined. The family may be divided into eight genera: thus,

Genus 1. CLEPSINE, (Sav.), *Erpobdellæ spec.* (Lam.), *Glossopora* (Johnson), *Glossobdella* (Bl.). *Body* composed of 76 segments. *Eyes* 2, 4, 6, arranged in longitudinal lines. *Jaws* reduced to three folds, without teeth.

Genus 2.—HÆMOPIS (Sav.), *Hirudo sanguisuga* (Lam. and Johnson), *Hippobdella* (Bl.). *Body* composed of 98 segments. *Eyes* 10, disposed in a curved line; six on the first segment, two on the third, and two on the sixth. *Jaws* tolerably large, not compressed; having about 15 blunt, flattened, and loose teeth.

Genus 3.—SANGUISUGA (Sav.), *Iatrobdeila* (Bl.). *Body* composed of about 100 segments. *Eyes* 10, arranged as in the preceding. *Jaws* large, well developed, compressed laterally, and bearing about 80 sharp firmly-implanted teeth.

Genus 4.—LIMNATIS (Moq. Tand.), *Bdella*, (Sav.). *Body* composed of 98 segments. *Eyes* 8, arranged in a semicircle; six on the first segment, and two on the third. *Jaws* hard and oval, but without teeth.

Genus 5.—AULASTOMA (Moq. Tand.). *Body* composed of 95 segments. *Eyes* 10, disposed in a curved line; the four posterior being smaller and more isolated. *Jaws* reduced to a multitude of little folds, without teeth.

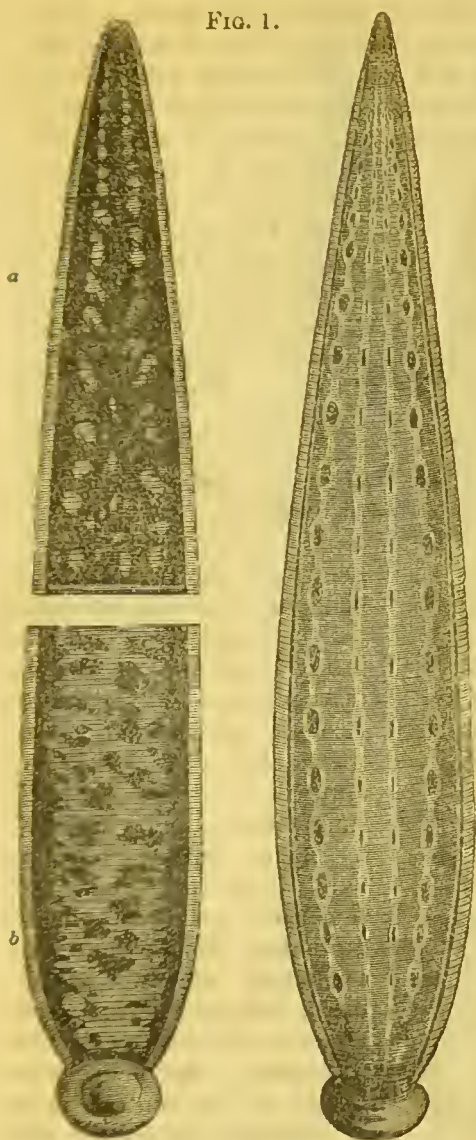
Genus 6.—NEPHELIS (Sav.), *Erpobdella* (Bl.), *Heluo* (Oken). *Body* composed of about 100 segments. *Eyes* 8, very distinct; the four anterior disposed semicircularly on the first segment, the other four on the third, either in a transverse or longitudinal direction. *Jaws* reduced to three distinct folds, without teeth.

Genus 7.—PISCICOLA (Lam., Moq. Tand.), *Hæmochâris* (Sav.), *Ichthyobdella* (Bl.). *Body* composed of innumerable segments. *Eyes* 4, 8, not distinct. *Jaws* reduced to three ridges, without teeth.

Genus 8.—ALBIONE (Sav.), *Pentobdella* (Leach, Bl.). *Body* composed of 58, 63, 65 segments, more or less tuberculated. *Eyes* 8, disposed in a transverse line. *Jaws* reduced to three points, hardly visible, and without teeth.

Such are the several genera of the family *Hirudinea*, and it will be seen that the genus *Sanguisuga*, or blood-sucking leech, is the only one of the eight whose jaws are capable of wounding the skin: it therefore becomes a question of considerable importance how to distinguish these; and the lecturer stated, as his opinion, that the *Sanguisuga* may be known by one or both of two characters. They have a continuous longitudinal stripe of a yellow or orange colour along each margin or side of the body; and secondly, when the abdomen is of a lighter tint, there should *always* be two lateral black stripes—one running down on either side. Every leech that did not present these, which may be called generic characters, should be rejected. A careful examination of a great number of leeches which have from time to time reached our markets, had led the lecturer to divide the genus *Sanguisuga* into seven species, which are more or less valuable as remedial agents: thus,

FIG. 1.



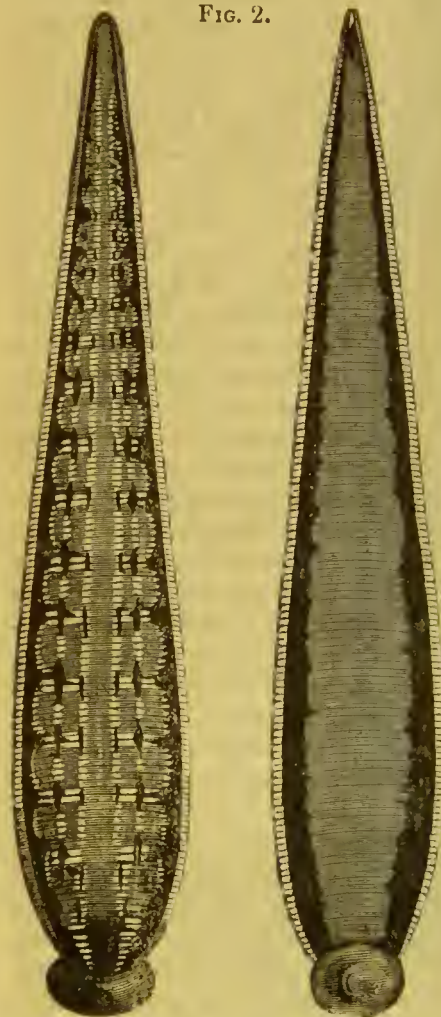
SANGUISUGA MEDICINALIS.

of our commercial leeches, drawing a large quantity of blood quickly and easily. It fetches in the market at this time 18s. per 100; and is imported, by way of Hamburgh, from the northern countries of Europe, such as Russia, Norway, Sweden, &c.; it was formerly collected in our own marshes, but from the combination of two circumstances, a large demand and a destruction of its haunts by an improved system of drainage, it is now nearly, if not quite extinct, and there appears to be a great difficulty in naturalizing the imported specimens.

Species 2., SANGUISUGA CHLOROGASTER, (Brandt), is now and

then met with among the speckled leeches from Russia; it has a *back* coloured exactly like the preceding, but the *belly* is of a brighter green tint, freckled with numerous small brownish-red spots. It was first described by Brandt as occurring at St. Petersburg, and appears to be of as good a quality as the *S. medicinalis*.

FIG. 2.

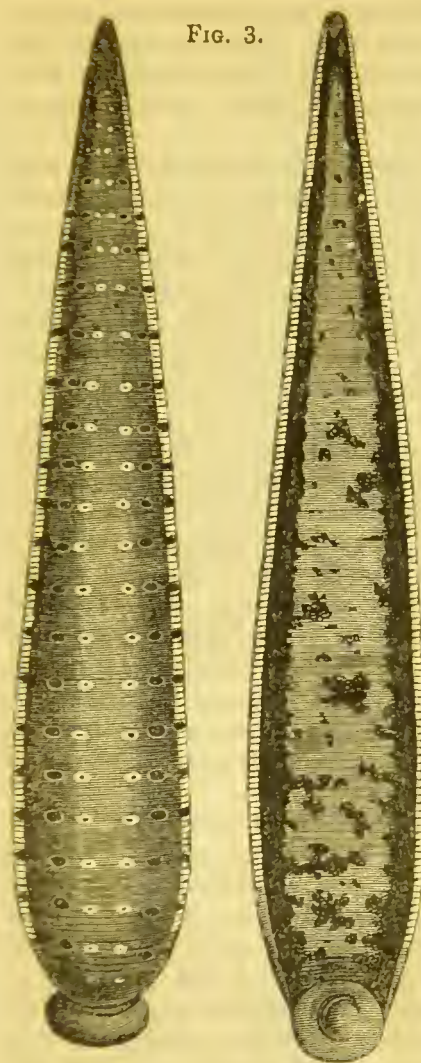


SANGUISUGA OFFICINALIS.

Species 3., SANGUISUGA OFFICINALIS, (Sav., Moq. Tand., Brandt). *Sanguisuga meridionalis*, (Risso). *Sanguisue médicinale verte*, (Bl.). *Hirudo officinalis*, (Geiger). *Hirudo provincialis*, (Carena). *Hamburgh and French green leech*. (Fig. 2.) Characters:— *Back* brownish olive-green, with six yellow or reddish longitudinal bands, the two marginal and the two central being the most evident, while the intermediate ones are rarely continuous or so well marked, and the spots or dashes which occur upon them at regular intervals, appear to be made up of smaller dots, which give them a ragged outline. *Belly* light dirty pea-green, or sometimes yellowish green, quite free from spots, but exhibiting the two lateral black stripes. There are two varieties of this species in commerce, one being collected in the central parts of Europe, and called the *German* or *Hamburgh green*; it is the largest and

best, fetching at this time 15s. per 100. The other variety is collected in the more southern countries, and is known as the *French* or *Spanish green*; they are of less value, rarely making more than 11s. per 100; they are of small size, and very unhealthy from a fraud which the natives are guilty of before exporting them, that is of filling them out with blood so as to improve their appearance, and make them look larger; they are consequently very indisposed to bite, and must be kept some time in the importer's ponds before they are saleable.

FIG. 3.



Species 4., SANGUISUGA INTERRUPTA, (Moq. Tand., Brandt). *Sangsue interrompue* (Audouin). *Sangsue marquetée*, (Bl.). *The interrupted Gibraltar green, or Morocco leech*. (Fig. 3). Characters:—*Back* of a beautiful pea or grass green; sometimes in the smaller varieties it has an ochre or brownish tint. The two marginal bands yellow, broad, and well marked, but the dorsal so interrupted as to be indicated only by a succession of spots, which occur at about every fifth ring. The two central rows are of a bright orange colour, while the two external and parallel spots on each side are black, the innermost being fringed with yellow. *Belly* generally of a duller green, spotted or unspotted, with the two marginal black bands always well marked. These leeches are collected in Morocco, where they yield a large revenue to the emperor, and are exported by way of Gibraltar. They frequently run of large size, are of good quality, and fetch about 14s. per 100.

SANGUISUGA INTERRUPTA.

Species 5., SANGUISUGA

VERBANA, (Moq. Tand., Brandt, Carena). *Sanguisuga carena*, (Risso). *Sangsue médicinale de verbano*, (Bl.). *Sangsue du Lac Majeur*, (Audouin). Characters:—*Back* deep dirty green, with the two lateral or marginal bands rusty yellow; along the middle of the back there is a double row of longitudinal ochre yellow stripes, each stripe running for the space of three rings; the back also exhibits a series of black transverse bands, which occur about every 6th ring. *Belly* brownish green, either without spots, or very small ones. This leech is common in some of the Italian lakes; it has not, to my knowledge, reached our market, and from what I can learn, it is of bad quality.

Species 6., SANGUISUGA OBSCURA (Moq. Tand.). *Sangsue Noire* (Bl.). *Back* either dark rusty brown, or black, with the central

dorsal bands very indistinct. The two lateral bands orange yellow. *Belly* greenish, spotted or not. This variety is frequently met with among the Spanish and French green; it is called the *dark Spanish*, and is of about the same value; it does not bite very readily.

Species 7., SANGUISUGA MARGINATA.—Such is the name by which the lecturer proposed to call a leech which has been sometimes imported from Spain. Its distinguishing characters are an almost black or very dark green *back* and *belly*. Having no spots, but a very bright yellow or orange marginal band running the full length of each side of the body. There have been but few samples imported, and these were found of comparatively inferior quality, biting with difficulty, and drawing but little blood.

Several species, continued the lecturer, besides the above have been described by Savigny, Derheims, Moquin Tandon, Blainville, and others; but none which he conceived of consequence to the English dealer. The following rules he proposed to lay down as a guide in the choice of leeches. The best have *six yellow or reddish longitudinal stripes along the back, and a spotted belly*. The next in order of value has the belly unspotted, and the larger they are, provided they have no blood in them, the better. The third in the list has a bright green back, with no dorsal stripes, but in their place six or eight rows of spots; and the least valuable are the leeches which have no marks at all upon their backs.

The lecturer then directed attention to the diseases of leeches, one of the most common forms of which exhibits itself as a constriction at some part of the body, as if a thread had been tied round it. These rarely recover, and will not always bite—a healthy leech is known by its contracting firmly into an oval mass when it is rubbed between the hands. It is a question with many whether leeches, after they have once bitten, should be employed again, and no doubt when they have attacked a contagious surface, there is some risk; but generally speaking, if the leech, after it has sucked, is drawn carefully, and not too quickly, between the finger and thumb, it may be emptied of its gorge, and in about three weeks is quite ready for another application.

PART II.—ANATOMY OF THE LEECH.

This was considered under the heads of the several systems:—

1. *Tegumentary System* is composed of three parts; an outer thin transparent layer, called the *cuticle* or *epiderm*, which readily peels off when a leech is dead and becoming putrid: during health it is shed about every fifth day, and constitutes those

delicate membraneous films and rings which are to be found floating in the water with the leeches; when unravelled they present a perfect cast of the animal. They have an amorphous structure, though, doubtless, in an early condition they were composed of plaster epithelium. One of the common causes of disease among leeches is an inability to throw off this tunic, and we may remedy the evil by placing small pebbles, or a piece of very porous sponge, in the water for them to crawl through. Beneath the epiderm is the *derm*, or *chorion*, or *true skin*: it is a highly contractile reticular tissue, inclosing numerous oblong *pigment cells*, arranged with their long axes perpendicular to the surface, to or from which they are capable of being moved by the partial contractions of the derm; and in this way, under particular circumstances, the colour of the skin is altered. The derm is excessively vascular, receiving most of its blood from the lateral vessels, and no doubt it performs a very important part in the function of respiration. The skin upon the inferior surface of the body is lubricated

FIG. 4.



Abdominal surface of the leech; (a) anterior disc; (b) posterior do; (c) penis; (d) vaginal opening; (e) mucus openings.

by a secretion, which is poured out from a number of very minute pores. They occur at the abdominal margin of every fifth ring (figs. 4, e, and 5), and lead to small vesicles (fig. 6, c), which Duges and others have very erroneously regarded as pulmonic sacculi; they are merely the recipients of a mucus formed by a set of looped glands, which lie upon and cross the lateral vessels (figs. 6, b, and 12).

2. *Muscular System*.—The principal muscles lie immediately beneath the skin, and are arranged in three planes or layers, namely an *external transverse*, a *middle oblique*,

FIG. 5.

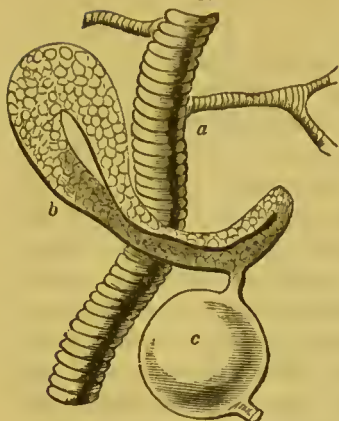


Openings of the abdominal mucus glands.

and an inner *longitudinal*. There is another and more internal perpendicular series, which serves to keep the viscera in place. The sucking discs are also provided with radiating and circular fibres, but they are only prolongations of the longitudinal and transverse muscles.

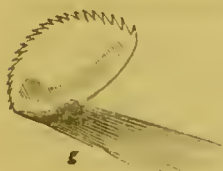
Other special muscles, to be described under the digestive system, have to do with the movements of the jaws and the act of sucking. The three first set of muscles are the principal agents of progression: thus, when the posterior disc has been fixed, the contractions of the transverse muscles will prolong the anterior extremity, while the oblique can effect a movement to either side; then the leech, having attached the mouth sucker, and loosened the posterior one, contracts the longitudinal set, especially on the abdominal

FIG. 6.



(a) Lateral vessel with transverse muscular markings; (b) a looped gland; (c) its mucous receptacle or sac.

FIG. 7.



Jaw of the leech, (g) the ad-rotator muscle.

FIG. 8.



(e e e) Three jaws; (f) circular or ab-rotator muscle; (g) ad-rotator, (h) oesophagus with longitudinal and circular muscles.

FIG. 9.



Section of oesophagus; (e e) jaws; (g g) ad-rotators; (i i) radiating or dilating muscles.

surface, and so shortens the body and brings forward the tail disc to be again fixed — Under the microscope the muscular fibres do not exhibit any of those cross markings which are so characteristic of the voluntary muscles of all other animals higher in the series.

3. *Digestive System.*—The *mouth* is situated in the centre of the anterior sucking disc, upon the inferior aspect of the body, and is surrounded or fringed by a very delicate and sensitive labium (fig. 4, a). Immediately within it are three semilunar *cartilaginous jaws*, arranged in a triradiate manner: they are armed in the blood-sucking

leeches with about eighty sharp calcareous teeth (fig. 7), whose points are all directed a little inwards, and they progressively increase in size from within outwards. In the horse-leech these teeth are blunt, few in number, and not firmly implanted in the jaw, so that it is deprived of the power of biting. Internally the three jaws are connected by an elastic ligament (fig. 8), which

has an opening for the gullet in its centre; externally they are attached to the parieties of the mouth by a circular band of muscles, the *ab-rotatores* (fig. 8, f); and passing from the inner angle of each jaw, downwards and outwards, there is another set, the *ad-rotatores* (figs. 7, 8, and 9, g).

The *oesophagus* intervenes between the mouth and the first compartment of the stomach; it has a globular or oval form, (fig. 10, a) and is surrounded by transverse and longitudinal muscles (fig. 8, h); a more external series radiate from it on all sides; they are the *dilators* of the oesophagus (fig. 9, i).

In the act of sucking, the anterior disc is attached firmly to the skin, by which means the jaws are brought to bear upon its surface, and then, by the alternate actions of the ab- and ad-rotator muscles, assisted by the longitudinal fibres of the oesophagus, the jaws are made to perform a half rotation; the down and inward stroke being the most effective. In this manner they gradually saw their way into the skin, making a triradiate wound. As soon as this is

effected, the radiating muscles of the œsophagus are brought into action, so as to dilate its globular part, and blood is thus sucked down to fill it. The transverse, or constrictor muscles now contract and force its contents into the stomach—by a succession of such acts the leech becomes gorged. The *stomach* (figs. 10 and 11) is an immense sac, completely filling the animal; it consists of ten or eleven compartments, with their lateral cæca; the two last

FIG. 10.

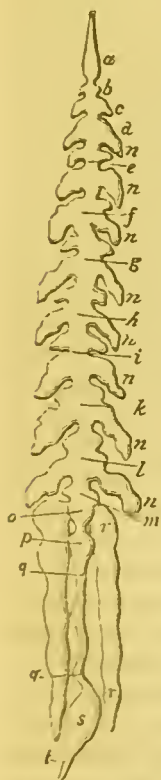


FIG. 10. Alimentary canal of leech empty; (a) œsophagus; (b to m) cæca; (n) small intestine; (s) rectum.

FIG. 11.

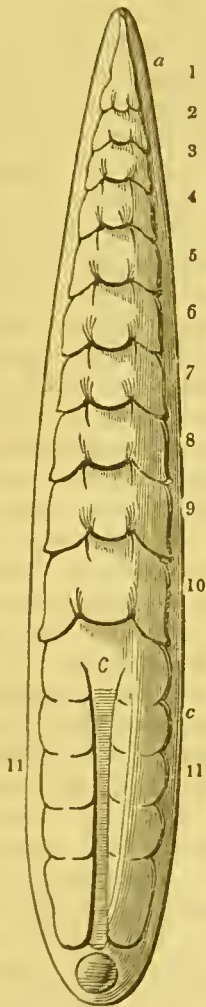
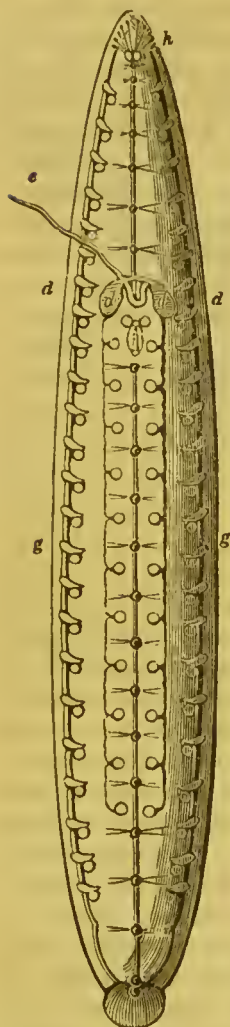


FIG. 11. — Alimentary canal of the leech filled with blood, composed of (a) œsophagus; (1 to 11) stomach with cæca; the two last (11, 11) prolonged; c small intestine.

4. *Vascular System* consists essentially of four longitudinal vessels, a dorsal, a ventral, and two lateral, together with a multitude of communicating branches. The *dorsal vessel* is formed posteriorly by the union of two parallel trunks, named from their position,

being prolonged quite to the extremity of the body. It has been a question whether these cæca are not supplementary glands; but from the readiness with which they are filled and from many analogies in other annelida, there can be no doubt of their stomachal office. They are lined upon their interior with large nucleated cells. The *small intestine* is a narrow tube arising from the last compartment of the stomach (figs. 10, q, and 11, c); it runs back between the two posterior cæca, and terminates in the *anus* or *vent* upon the dorsal edge of the disc: it is covered internally with minute transverse folds, *valvulæ conniventes*, and exhibits the openings of the biliary ducts. Sometimes before it terminates in the anus it becomes dilated, and forms a *rectum* or *large intestine* (fig. 10, s, t). The *supplementary glands*, which have been described by Brandt and others, are the *salivary* and *hepatic*. The former exists as a white stratum around the œsophagus, and the latter as a layer of small brownish cæca upon the ventral surface of the stomach: their tubes unite to form two ducts, which terminate at the commencement of the small intestine.

FIG. 12.



The various parts in situ—In the central line is the double nervous cord, on each side of this the eleven pairs of testes, with the zig-zag vas deferens, which terminates in the vesicula seminalis (*dd*), between which is the penis (*e*) and its bursa; (*f*) the uterus and two ovaria; (*g g*) the two lateral vessels, with the looped glands and sacculi; (*h*) the ten eyes.

dorso-intestinal and *dorso-dermal*; it proceeds forwards to the head, and there divides into two branches, which surround the gullet, and unite below with the ventral vessel; in its course it gives off numerous transverse branches, which ramify principally upon the alimentary canal. The *ventral vessel* arises from the two œsophageal branches of the dorsal, and passes backwards, in immediate apposition with the nervous cord, to end in a multitude of small branches, which are lost in the posterior sucker, its branches correspond with those of the ganglia, and are distributed for the most part upon the stomach, a few are also sent to the skin and muscles. The *lateral vessels* (fig. 12, *g*) proceed in a wavy course, one up on each side of the body; they communicate with each other at both extremities, and also during their course, by numerous transverse branches, which creep under the stomach; at regular intervals, they give off a short trunk, which divides almost immediately into two branches, a *dorso lateral* to be distributed upon the skin of the back, and a *latero abdominal* which goes to the integument of the abdomen. Towards the posterior third of the body, the dorso lateral branches increase very much in size, and unite over the intestine to form about six arches, which are brought into communication by two longitudinal trunks; all the branches of these four vessels inosculate very freely with each other, and the principal ones are covered with circular muscular fibres (fig. 6, *a*), by the agency of which they pulsate or contract upon their contents, and I believe that the blood does not pursue any determinate or regular course, but that it sometimes undulates in one direction, at other times in the opposite. When a leech is opened alive, the lateral vessels are seen to pulsate about ten or eleven times a minute, but the order of pulsation is not regular; it is moreover probable

from the distribution of the blood, that the dorsal and ventral vessels preside over the functions of nutrition and absorption, while the lateral have to do with respiration; but their free inosculation must necessarily produce a frequent interchange of the contents. The *blood* of the leech is of a red colour, and contains a few

irregular nucleated globules or corpuscles, which vary in size from about the $\frac{1}{8000}$ th to $\frac{1}{4000}$ th of an inch.

5. *Respiration*.—This is no doubt performed by the skin, although Duges and others have assigned it to the looped organs and sacs (fig. 6, *b, c*) which lie upon the lateral vessels, but their position, structure, and contents, warrant the belief that they are mucus glands.

6. *Nervous system* consists of a brain and a series of ganglia, connected by a double nerve along the abdomen (fig. 12). The *brain* or *supræesophageal* ganglion is situated over the œsophagus, it gives off ten optic nerves (fig. 12, *h*), and several branches to the labium; two large commissural nerves pass off from it laterally to wind round the gullet, and join the *first ventral* or *subesophageal* ganglion, which, from its supplying all the muscles about the mouth, may be regarded as the analogue of the *medulla oblongata*. The other ganglia, about twenty-two in number, give off transverse branches in their course to the muscles and viscera, and are the representatives of the *spinal cord*. They are interesting microscopic objects, inasmuch as they exhibit the manner in which the several nervous fibres cross to form commissural loops, and they show also how they are brought into communication with the ganglionic cells. *Organs of special sense*.—We are not prepared to say that the leech is endowed with more than three senses, those of sight, taste, and touch, all the apparent manifestations of *feeling* may be merely reflex actions. The *organs of vision* consist of ten black mullar-shaped eyes, arranged in a semicircular form upon the upper surface of the anterior disc (fig. 12, *h*); they are mere expansions of the optic nerves, covered posteriorly with a black pigment, they have no lens or other focal contrivance, and can, therefore; only be subservient to the bare discrimination between light and darkness. *Sense of taste* is presumed to exist from the circumstance of their selecting or refusing certain foods, and it is no doubt situated in the labium, which is also a delicate *tactile organ*.

7. *Reproduction*.—The leech like the rest of the annelida, is *androgynous*, each individual possesses both male and female organs, but they are incapable of self-impregnation. *Male organs* (fig. 12).—There are from nine to eleven pairs of *testes*, placed along the abdominal surface between the folds of the cæca. Their short ducts pass outwards to join a long zigzag tube, the *vas deferens*: it runs up along their outer margin, to terminate in or form by a great number of convolutions, the body called the *vesicula seminalis* (fig. 12, *d*); from this there passes off a tolerably large muscular tube, the *ejaculator seminis*, to enter the base or *prostatic* portion of an organ which is bent upon itself, and encloses the penis, hence named the *bursa* or *sheath* of the penis. This opens externally upon the abdominal surface of the twenty-fourth ring, the penis can be protruded to the extent of

half-an-inch (fig. 4, *c*, and 12, *e*), it has a tortuous urethra, and a granular structure at its apex. The contents of the sperm glands when examined at different periods of the year, illustrate the manner in which the spermatie filaments are developed, at first the cells appear with one or two large nuclei, subsequently these nuclei break up, and the cell becomes filled with minute granules (*nucleoli*), these soon arrange themselves in a linear form, and after a time exhibit a vibratile motion. The cell then breaks, and the perfected spermatozoa escape. *Female organs* (fig. 12, *f*) are situated immediately below the bursa penis, and between the two vesiculæ; they consist of two *ovaria*, whose tubes unite to form a short and slightly flexuous *oviduct*, which joins the lower end of a pear-shaped *uterus*, the tube or vagina of which opens five rings below the penis (fig. 4, *d*). The parieties of the uterus are very muscular.

8.—*Impregnation and Development of the Ova*.—In the early state the ova are seen in the ovaria and oviducts as minute globules, consisting of a germinal vesicle and its yelk; lower down they receive a covering of albumen; and when they reach the uterus they are in a condition to be fœcundated. Leeches copulate by reversing the direction of their bodies, and bringing the male organ of the one into juxta-position with the vulva of the other, so as to effect a mutual impregnation. Soon after this the uterus is found to be considerably distended, and the next duty is to relieve it of its burden. The blood-sucking leeches bury themselves in the mud at the sides of the pond when they deposit their ova, and consequently the process cannot be watched; but Dr. Johnson has described the manner in which it is accomplished by the rivulet-leech (*Hirudo vulgaris*): he says, "Four or five days after copulation it exhibits a contraction above and below the uterus, and fixing itself by its posterior sucker, which it never loosens during the operation, it throws out a milky white substance between the constrictions, and by a great effort expels the whole of the contents of the uterus into it. This done the animal narrows its body and withdraws itself from the ring. The capsule thus formed is excessively elastic and of no determinate figure, but the leech fixes it to some object, and with its mouth fashions it into an oval body, called a Cocoon, leaving the points from which it drew itself out weaker than the rest. These cocoons contain about six or eight ova, enveloped in a jelly-like fluid; they gradually enlarge, and in six weeks the young leeches are matured and ready to escape. The cocoons of the medicinal leech are about an inch long; they look like an oval piece of sponge, and contain from six to fourteen ova. I have no doubt that they are formed in a similar manner. There is an opinion prevalent that the leech takes charge of the cocoon, and has something to do with its maturation, and also that it is occasionally viviparous; but I am inclined to think that both of these opinions are without foundation.